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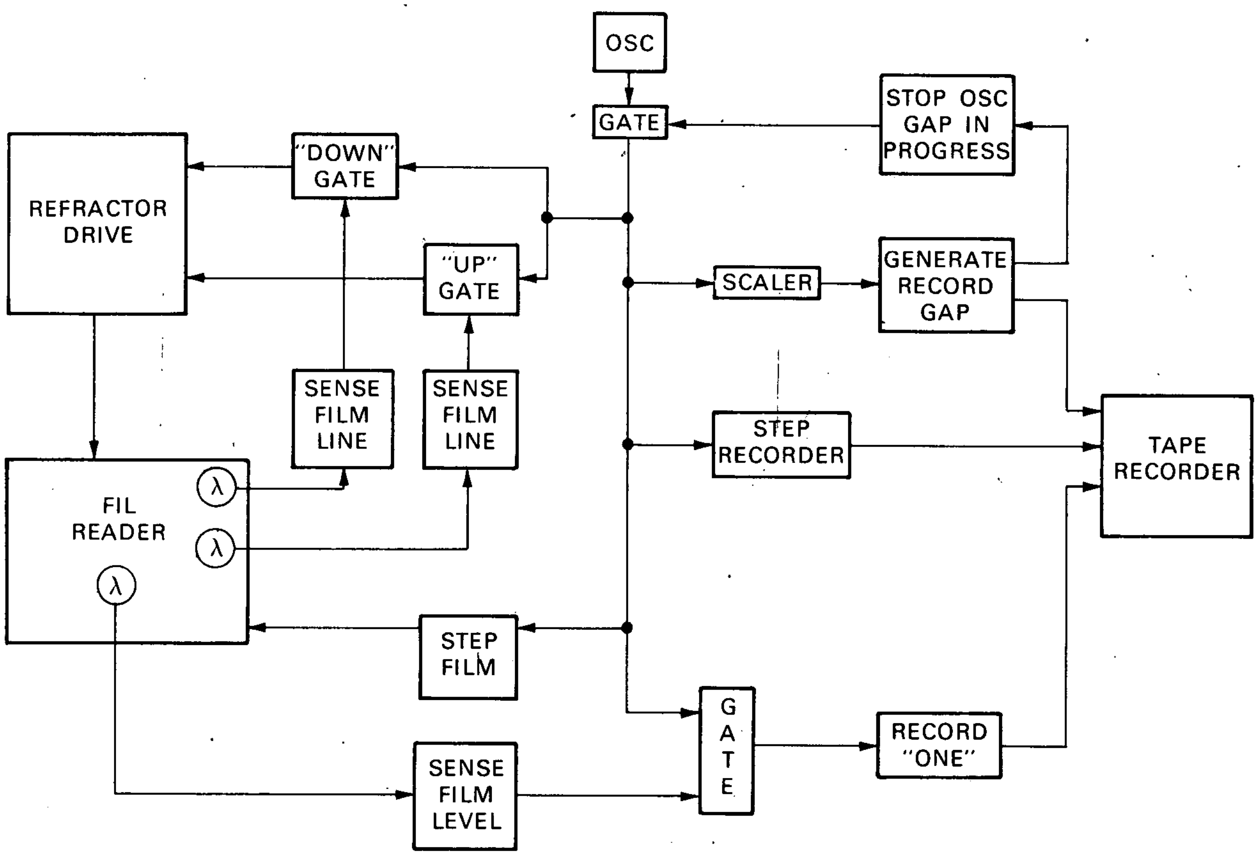
NASA TECH BRIEF

Pulse Rates Recorded by Digital Film Positioner



The problem:

To record accurately the pulse rates of various detected energy impulses (X-ray, infrared; etc.) and to convert them to a digital format for use in computer processing.

The solution:

A system that first converts detector pulse rates to photographs of binary scale indicator lights on continuously moving film. The resulting record consists of parallel trails of dashes and gaps along the film, each dash and gap being inversely proportional to the time required to accumulate the preset number of counts set by scaling factors. In order to read and digitize the recorded data for computer processing, the system scans the film and transfers the data to computer-compatible magnetic tape.

(continued overleaf)

How it's done:

Mechanically, the system operates in the following manner. Film (35 mm has been used in a prototype) is drawn through a projection gate at the rate of 70 steps per sec, each step being 3/400 in. or 0.019 cm. Energy from a light source is concentrated by a condenser to project the film image through a lens to the back of a light-tight box. A photodiode in the center of a small screen can be controlled up or down so that the image of a selected trail of dashes and gaps falls on it. Output of the diode is fed to a digital incremental tape recorder driven synchronously with the film transport. When the trail is black (dash), a zero (0) is recorded; when clear, a one (1) is recorded. Vertical and horizontal parity check bits are generated within the recorder. Physical record gaps are generated after each set of 768 characters if the system is so commanded.

To counteract vertical motion of the image, due to slight lateral movement of the film, an image stabilization system has been devised. A fiducial light on the original data panel is photographed continuously. The projected dark image of this light falls across two additional sense diodes. If either of these receives a signal above a predetermined intensity threshold, it causes a stepping motor to rotate a lucite refractor that moves the image up or down in a compensating manner. In this way, the image impingement on the sensing photodiode is held constant.

Operation of the electronic logic circuitry is illustrated in the block diagram. A 70 Hz free-running oscillator supplies timing pulses to all circuits through a gate. With the scaler reset to zero, a manual start command causes oscillator pulses to enter the scaler, one terminal of the record "one" gate, the recorder advance driver, the film advance driver, and the image hunt circuits. As the film reader and the recorder step with the drive pulses, the sense diode, through a Schmitt trigger, opens and closes the record "one" gate. This causes "ones" or "zeros" to be entered on the magnetic tape. This sequence continues uninterrupted until the scaler overflows at 768 counts, at which time a univibrator is triggered, temporarily closing the oscillator gate. A record gap is generated by the recorder at this time. When one of the fiducial sense diodes (sense film line) detects a signal above a certain threshold, oscillator pulses are fed to the refractor drive through either the "up" gate or the "down" gate, and the trail image is thus held on the photodiode.

Notes:

1. Although no attempt has been made to record more than one trail at a time, since the films to be digitized are made on several instruments and have dissimilar spacings, it is evident that the system could be readily expanded to record six trails at one time.
2. In recent experiments, 35 mm film has been digitized to magnetic tape from as many as 62 parallel trails.
3. Requests for further information may be directed to:

   Technology Utilization Officer
   NASA Headquarters
   Washington, D.C. 20546
   Reference: B70-10141

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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